

## CLAIMS

What is claimed is:

1. A method for canceling noise on a signal received on a communication channel, the method comprising:
  - receiving the signal, wherein the signal comprises a differential mode noise component and a differential mode signal component;
  - processing the signal to isolate a common mode component;
  - filtering the common mode component to create a cancellation signal;
  - combining the cancellation signal with the signal to cancel the differential mode noise component from the signal to thereby isolate the differential mode signal component;
  - outputting the isolated differential mode signal component.
2. The method of Claim 1, wherein filtering comprises performing processing with a digital filter to thereby cause the common mode noise component to more closely resemble the differential mode noise component.
3. The method of Claim 1, wherein the channel comprises a twisted pair of conductors.
4. The method of Claim 1, wherein the method is performed on the signal received over each channel of a multi-channel communication system.
5. The method of Claim 1, wherein processing the signal to isolate the common mode component comprises isolating the common mode component utilizing one or more transformers.

6. A method for processing a received signal in a multi-channel communication system to reduce unwanted noise, the method comprising:
- receiving two or more signals over two or more channels, wherein each of the two or more signals comprise a differential mode component and a common mode component;
  - for at least one channel of the multi-channel communication system:
    - isolating the differential mode component through a differential mode isolation unit
    - providing the differential mode component to a junction;
    - isolating the common mode component through a common mode isolation unit
    - providing the isolated common mode component to a filter;
    - processing the common mode component with the filter to generate a cancellation signal;
    - providing the cancellation signal to the junction; and
    - combining, within the junction, the cancellation signal with at least one signal received over the at least one channel to thereby remove the noise in the differential mode component from the signal received over the at least one channel.
7. The method of Claim 6, wherein the at least one channel comprises at least one twisted pair of conductors and the common mode component may be correlated to the noise in the differential mode component.
8. The method of Claim 6, wherein processing the signal with the common mode isolation unit comprises providing the signal to at least one transformer stage to thereby isolate the common mode noise component.
9. The method of Claim 6, wherein processing with the filter comprises processing the common mode component with a digital filter having coefficients selected to modify

the common mode noise component into a cancellation signal tailored to cancel the noise present on the differential mode component of a particular channel.

10. The method of Claim 6, wherein processing with the filter comprises processing each common mode component isolated from each signal received over each channel with a filter tailored for each channel.

11. A communication system for processing a received signal to isolate and cancel noise from two or more incoming signals comprising:

- two or more inputs configured to receive two or more incoming signals;

- at least two common mode isolation units configured to isolate the common mode component of the two or more incoming signals, wherein a common mode isolation unit comprises:

  - at least one transformer configured to isolate a common mode component;

  - at least one digital filter configured to receive the common mode component and process the common mode component to generate a cancellation signal;

  - at least one junction associated with at least one channel configured to receive the cancellation signal and combine the cancellation signal with at least one of the incoming signals received over the channel with which the junction is associated, wherein combining the cancellation signal with an incoming signal removes unwanted noise from an incoming signal.

12. The system of Claim 11, wherein the common mode isolation unit comprises:

- a first input configured to receive a first signal from a first channel;

- a second input configured to receive a second signal from a second channel;

- a first transformer configured to receive the first signal, wherein the first transformer has a center tap configured to output a first center tap signal;

a second transformer configured to receive the second signal, wherein the second transformer has a center tap to output a second center tap signal;

an amplifier configured to receive the first center tap signal and the second center tap signal and output the common mode component.

13. The system of Claim 11, wherein the common mode isolation unit comprises:

a sensing transformer configured to receive the signal and generate one or more electric fields thereby generating a sensing winding signal in a sensing winding of the sensing transformer;

an amplifier configured to receive the sensing winding signal or a signal representing the sensing winding signal and output a modified version of the sensing winding signal, wherein the modified version of the sensing winding signal comprise the common mode component.

14. The system of Claim 11, wherein the common mode isolation unit comprises:

a first transformer, having a center tap connection, configured to receive the first signal;

a sensing transformer configured to receive the first signal and thereby generate one or more electric fields which in turn generates a sensing winding signal in a sensing winding;

an amplifier configured to receive and amplify the sensing winding signal, which represents the common mode noise signal, and output a modified version of the common mode noise signal.

15. The communication system of Claim 11, further comprising a line isolation unit associated with each channel, wherein a line isolation unit is configured to isolate the communication system from the communication channel.

16. The communication system of Claim 11, wherein the junction comprises a summing junction.
17. A method for canceling unwanted noise from a signal received over a multi-channel communication system comprising:
- receiving two or more signals over two or more channels, wherein each signal comprises a differential mode component and a common mode component;
  - processing at least one of the two or more signals to isolate a common mode component associated with at least one of the two or more signals;
  - filtering the isolated common mode component to create a cancellation signal;
  - and
  - combining the cancellation signal with at least one received signal or at least one differential mode component to reduce noise in the differential mode component.
18. The method of Claim 17, wherein processing comprises obtaining a center tap signal from a center tap of a transformer configured to receive the at least one signal, wherein the center tap signal comprises the common mode noise component.
19. The method of Claim 17, wherein processing comprises generating one or more electric fields by passing the at least one signal through at least one winding of a sensing transformer to thereby generate a sensing winding signal in a sensing winding of the sensing transformer, wherein the sensing winding signal represents the common mode noise signal.
20. The method of Claim 17, wherein processing comprises obtaining a center tap signal from a center tap of a first transformer and generating one or more electric fields by passing the center tap signal through at least one winding of a sensing transformer to thereby generate a sensing winding signal in a sensing winding of the sensing

transformer, wherein the sensing winding signal represents the common mode noise signal.

21. The method of Claim 17, further comprising amplifying the common mode noise signal prior to filtering.

22. The method of Claim 17, wherein the multi-channel communication system operates in a discrete multi-tone modulation environment.

23. The method of Claim 17, wherein the processing and filtering occurs on a frequency bin by frequency bin basis and the two or more signals are modulated based on a discrete multi-tone modulation scheme.

24. A system for canceling unwanted noise from a signal received over a multi-channel communication system comprising:

means for receiving two or more signals over two or more channels, wherein each signal comprises a differential mode component and a common mode component;

means for processing at least one of the two or more signals to isolate a common mode component associated with the two or more signals;

means for filtering the isolated common mode component to create a cancellation signal; and

means for combining the cancellation signal with at least one received signal or the differential mode component to cancel or reduce noise in the differential mode component and thereby isolate a signal of interest.

25. The system of Claim 24, wherein the means for processing comprises one or more transformers configured to reject the differential mode component to thereby isolate the common mode component.

26. The system of Claim 24, wherein the means for filtering receives a common mode component associated with each signal received over each channel of the multi-channel communication system and processes the common mode component to approximate the noise in the differential mode component.